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ABSTRACT

Meeting nutritional needs of children in West Virginia is vital to the state's economic development. A malnourished, uneducable population will be unemployable in a high tech society and the state cannot afford custodial and welfare costs resulting from childhood malnutrition. Evidence of nutritional need in West Virginia includes low rate of participation in Food Stamp and Women, Infant and Children Supplemental Food Programs, dependence on food bank supplies high in fat and cholesterol, low birthweights, the nation's highest postneonatal mortality rate, short stature of school children, and high unemployment rates. Other effects of malnutrition include light weight, decreased mental capacity, and susceptibility to infection. Other states and nations have developed nutrition policies to produce an educable population. Increased aid to families in Maine, Vermont, and Massachusetts resulted in lower infant mortality rates. Japan's post-war nutrition policy increased the size and performance of its population. Recommendations for improving nutritional status include a state government policy panel and position responsible for nutritional well-being, statewide nutritional/health survey, and nutritional screening at school entry. Supplementary tables accompany the text. A 73-item reference list is included. (LFL)

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THE POSSIBLE EFFECTS OF NUTRITIONAL STATUS AND GROWTH OF CHILDREN ON THE ECONOMIC POTENTIAL OF WEST VIRGINIA

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October 1985

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EXECUTIVE SUMMARY

The economic potential of a society is dependent on the health and vitality of its population. In turn the health and wellbeing of a people is directly dependent on the quality and quantity of food available to each individual. Government, business, labor and education leaders in West Virginia are currently involved in a concerted effort to spur the economic development of the State. Whatever steps are taken in the short term to achieve these ends, the long term view must also be considered especially as it pertains to the development of a vital, educated and employable workforce.

I. EVIDENCE OF NUTRITIONAL NEED IN WEST VIRGINIA.

A. THE FOOD STAMP PROGRAM.

Currently, 93,000 of the State's 686,300 families or 14% participate in the Food Stamp Program; it is estimated that 164,700 or 24% may be eligible for this program.

The allowance for Food Stamp amounts to only $1.61 per person per day.

Food stamps are intended as a supplemental food source but in fact they are the entire food source for most of the recipients.

B. FOOD BANKS.

They exist to help meet the emergency food needs of households.

Food is donated by the food industry and the United States Department of Agriculture Surplus Food Programs.

Most of the available food consists of butter and cheese, high in fat and cholesterol.

C. THE WOMEN, INFANT AND CHILDREN SUPPLEMENTAL FOOD PROGRAM (WIC).

This program was developed nationally to prevent low birthweight

infants and ensure the growth and development of infants and young children through the provision of foods of high nutritional value.

Demonstrable results have been shown nationally, but in West Virginia the program is serving less than 30% of those eligible.

D. LOW BIRTHWEIGHT.

Low birthweight is assocated with the nutritional status of the mother prior to and during pregnancy.

There has been very little improvement in low birthweight rate over the last decade.

Low birthweight and short gestation continutes to be the fourth leading cause of death.

Saving the low birthweight infant is very costly to the State of West Virginia.

E. INFANT MORTALITY RATES.

Low birthweight infants die at 30 times the rate of the normal birthweight infants.

West Virginia's white infant mortality rate has consistently been among the three highest in the United States.

The postneonatal mortality rate in West Virginia is highest in the nation.

F. HEIGHTS OF CHILDREN AT SCHOOL ENTRY.

Ill fed children tend to be of short stature.

In a West Virginia county (which ranks among the top 20% per capita income) it was found that the children were shorter than accepted standards.

G. UNEMPLOYMENT RATES.

Unemployment continues to be a problem in West Virginia.

As unemployment rises so does the mortality rate not only for workers but for their wives and children.

West Virginia has the highest proportional costs for Worker's Compensation in the country.

II. THE EFFECTS OF MALNUTRITION ON THE HEALTH OF CHILDREN.

Low birthweight and infant mortality are among the early consequences of malnutrition.

Shortened stature and light weight is a demonstrable effect of under nutrition.

There is a symbiotic effect between nutrition and infection in that as nutrition status decreases, susceptability to infection increases.

There is a causal relationship between malnutriton and decreased mental capacity.

Studies show that malnutrition is associated with lifelong response to stress.

III THE EXPERIENCE OF OTHER STATES, NATIONS.

A. MAINE AND VERMONT.

Infant mortality rates have been substantially lower than West Virginia's in states with similar demographics where increased aid to families has been provided.

B. MASSACHUSETTS.

Although Massachusetts experienced high unemployment and economic devastation over the last three decades, aid to families in need remained relatively high.

Currently Massachusetts has the lowest unemployment rate in the

country and one of the highest per capita income rates in the country.

C. JAPAN

Japan instituted a national nutrition policy aimed at increasing the size and performance of its population.

Japanese youngesters now approximate the size of westerners.

Japan has become an economic world power based on its technological advances.

D. COLOMBIA.

A national nutrition policy was instiuted in Colombia in order to produce an educable population. Most industrialized countries and many of those developing have instituted such policies.

E. SCANCANAVIA.

Scandanavia's willingness and ability to ensure a relatively high standard of living for all of its population has been rewarded by the worlds lowest infant mortality rates.

Sweden is the only country where a generation has achieved full growth potential.

IV CONCLUSIONS.

There is no justification for anyone to be a nutritional risk in this society. Resources exist at the state and national level to allievate the situation; they need only be judiciously applied.

Ill born children do not survive and ill-fed children do not fully develop physically, mentally or emotionally.

A population that is uneducable at the level of todays high tech society is and will be employably only at the lowest skill levels.

West Virginia cannot afford the costs currently being incurred as a

result of inadequate and improper feeding of its population. The cost of saving a single low birthweight infant is only the beginning -lifelong custodial care for those severely impaired is upwards of $350,000 per child and special education and health care costs another $123,000 for each child needing such services. Additionally, decreases in the lifetime earnings of the undereducated and increased disability costs must be considered along with other dollar costs and costs in social and personal realms.

V. RECOMMENDATIONS.

A. That there be a panel of West Virginia's leaders in government, education, business and labor convened to further explore this issue and make recommendations as to how these groups might best combine forces to ensure a well fed, and thus productive and viable population in West Virginia.

B. That a statewide nutrition and health survey be conducted to assess the present nutritional status of West Virginia's population.

C. That a monitoring and surveillance system be put in place to ascertain the nuitritional wellbeing and growth status of West Virginia's children on a continuing basis. Mandated statewide nutrition screening of children at school entry would be a beginning, although it will be already too late at that point to fully restore those found to have been deprived during the preschool years.

D. Appoint a single well placed individual within state government whose business it is to oversee the nutritional wellbeing of West Virginia's children.

I. INTRODUCTION: ECONOMIC POTENTIAL AND NUTRITION.

It has long been obvious that the relative wellbeing of a population depends on the socioeconomic development of the society in which its members live. Less attention has been given to the extent to which the converse is true: the economic attainment of a society is dependent on the health and vitality of the population. Nor has there been adequate note taken of the evidence that a group's overall health is attributable to its nutritional status and the quality of diet. This paper will look at available indications of unmet nutritional needs in West Virginia, the expected effects on the health of the state's children and possible effects on economic potential.

Questions about the existence of hunger or the adequacy of diet and their effects on the growth and development of children in a society are usually humanitarian inquiries. Perhaps they are also relevant in the sphere of economics in terms of enlightened self interest, particularly if a healthy and educable workforce is among the society's goals.

Nutritional status as a factor in economic development has been recognized. When after their crushing defeat in WW II, and several years of enduring a devastated post-war economy, the Japanese resolved to enter the economic sphere as a world power, one of the first steps taken was to institute a national nutrition policy aimed at ensuring the growth and development of the rising generation. This occurred at a time when the full effects of poor feeding were barely guessed at; the object was to increase physical size, at least partly as a matter of national pride. Since that time Japanese youngsters have approximated those of the West in size, and we are acutely aware of Japan's progress in the technological world. Could their intellectual and economic strengths also be, in part, attributed to

the deliberate decision to develop a more nutritionally sound population?

Honigmann (1), a leading anthropologist, some years ago attributed the northwest American Indian tribes' accumulation of wealth and their highly developed civilization to the availability of high quality protein in the form of fish from the Pacific. Tanner (2) and others in child development equate physical growth with nutritional status. Nutrition then can be viewed as determining not only the child's health but in turn the nation's health and subsequent well being.

A number of countries, including those in developing areas such as Colombia and the Dominican Republic, have instituted national nutrition policies with the intention of producing a physically fit, intellectually viable and therefore more educable workforce. Most western industrialized countries, recognizing that nutritional deficiences had rendered an unacceptable percentage of military recruits unfit for service, have had such policies for some time. Similar high rejection rates for recruits during the last half century in the United States have also occurred. We in the United States, however, have been reluctant to declare a full scale effort for remedying nutritional deficiences among our population although some effort has been made.

The earliest attempt was the school lunch program which was originally launched in response to the high rejection rates for draftees and is still the most widely accepted public endeavor to enhance nutritional status. Unfortunately, even this program has suffered retrenchment in recent years. Additionally, there are data indicating that by school age it may be too late to effectively correct the physical, mental and emotional effects of poor nutrition.

Public sentiment seems to contend that in the world's leading food producing country, food is available to all. But in truth this has never

been so. Food is, and has been, available to those who can pay for it. Nutrition surveys undertaken in the late sixties and early seventies, including the Ten State Nutrition Survey (3) and the United States Health and Nutrition Evaluation Survey (4), documented food and nutrition problems, particularly among the more vulnerable of the poor -- pregnant women, infants and young children. These data seem to have been forgotten, or perhaps it is believed that government food programs and the expanding economy of the early seventies were sufficient to solve the problem. Instead, the high unemployment and domestic spending policies of the past few years, including cut-backs in government food programs, would seem to have eliminated any gains made during the prior twenty years. Now we are asking not only whether the American diet is nutritionally sound; but once again, is there hunger in the United States? In West Virginia? The answer to both questions seems to be yes (5, 6). For those of us particularly interested in West Virginia, the latter question is of great concern.

II. UNMET NUTRITIONAL NEEDS IN WEST VIRGINIA.

What evidence is there that some West Virginians are in need of additional food, despite food stamps and other related programs? What evidence is there that diets in West Virginia are too often inadequate to maintain health? And if there is evidence, what relevance would that have for the state's desire and need to attain its economic goals? Unfortunately there is not adequate data available on the dietary intake, nutritional status or the physical development of West Virginia's population. Inferences can only be drawn from secondary data sources such as food distribution programs and vital statistics records. Let us examine some information currently at hand.

1. The Food Stamp Program: Currently, 93,000 of the state's approximately 686,300 families (or 14 percent) are on the Food Stamp Program, although it is estimated that 24% or 164,700 of West Virginia households may actually be eligible for food stamps.

In a study conducted in Eastern Kentucky (9), it was found that those who were eligble for, but not participating in, the Food Stamp Program consisted of families who either out of pride or fear were reluctant to deal with local social service offices.

Over the last three years, $15 million worth of food stamps were distributed each year in West Virginia. Food stamp families average 2.85 members, about the same as the average members per household for the United States. The average United States monthly expenditure per family for food at the grocery store is $262 (7), not including food purchased elsewhere such as in restaurants or from vending machines. The average monthly food stamp allotment per family in West Virginia is $138 or 53 percent of the United States average expenditure. The food stamp allowance amounts to $48 per person per month or $1.61 per person per day (8). Inflation decreases the value of even this amount monthly.

Although food stamps are now provided without a cash contribution on the part of the recipient, the food stamps allocated are only intended as a suppplement to the household's food supply. Given the lack of other funds, however, foods purchased with food stamps do not supplement the food source; they are the food source.

2. Food Banks: Food banks help meet the emergency needs of many households that are not eligible for food stamps or whose allotment does not last the month. These are privately organized and funded food depots which receive food from both the USDA's Surplus Food Program and from the food industry.

Privately donated food is food that is wholesome but not up to company standards in some way, or food that is about to pass its expiration date. Both the government surplus and the industry donations consist of whatever is not wanted or deemed quite fit for sale. It is not possible to forge a balanced diet from the food provided. The food banks are not in the nutrition business, either in terms of quantity or quality; their aim is to alleviate hunger as best they can with what they have.

Approximately 1,000 tons of privately donated food passed through the central food bank for West Virginia at Gassaway this past year (10). In addition, surplus food distributed through local food banks and county offices totaled 8,300 tons. While cornmeal, flour, rice, dried milk and honey were provided (11), most of the available food (5,750 tons) was cheese and butter no longer wanted by a weight and cholesterol-minded American public.

Those receiving assistance from food banks are:

a. Young families with unemployed heads of households.

b. Young single mothers or grandmothers who have assumed responsibility for their families.

c. Unemployed older workers with families.

d. "Senior Citizens" - a group who are most often referred by community agencies and who tend to participate reluctantly.

e. "The regulars" - those relatively few families who represent multigenerational welfare families who have perennial need (12).

Women of childbearing age and young children tend to be disproportionally represented in households seeking food aid. Although it makes no

sense that any individual does without sufficient food in a country which consistently produces more than it can use, it is the fetus, infant, and young child who are most vulnerable to the effects of undernutrition or malnutrition. These are the people that society can least afford to have malnourished, as they represent the future stock of the country and will have a lasting effect upon society's aspirations for economic development. Losses of potential due to malnutrition in pregnancy, infancy or early childhood are never fully recouped.

Furthermore, West Virginia has one of the three highest heart disease mortality rates in the nation (13). The preponderance of studies has shown that low socioeconomic status is associated with high rates of heart disease, and recent evidence suggests that high fat diets in childhood may lead to obesity and early heart disease (14, 15). While preventing outright starvation, the high proportion of animal fat in the surplus food may be contributing to the excessive death rate of West Virginia's adult population.

3. The Women, Infant and Children Supplemental Food Program: (WIC): Women who have themselves been nutritionally deprived or who fail to gain an adequate amount of weight during pregnancy tend to deliver low birthweight infants (2500 grams - 5.5 pounds - or less). Failure to gain weight adequately during pregnancy may be due to gestational complications, insufficient caloric intake, or tobacco or alcohol use. Low birthweight infants are at about a thirty-fold increased risk of dying and have nearly a hundred percent chance of experiencing problems in growth and development. The WIC program represents a national effort to provide quality foods to infants, young children and pregnant women at nutritional risk. Aimed at

preventing low birthweight infants and ensuring the growth and development of infants and young children, it provides a means of making available adequate calories and essential nutrients commonly lacking in the diets of many disadvantaged women and children.

Evaluations of the WIC program show that WIC has been effective in improving the outcome of pregnancy (16). Studies have shown a 21-33 percent decrease in low birthweight incidence among those participating in the program. Mean birthweights for WIC infants were up to 60 grams higher than for non WIC infants; and those women who participated in the program seven months or longer produced the largest infants.

In a recent study where women remained in the WIC program between pregnancies, the gain in mean birthweight was 160 grams for the second pregnancy. Corroborating evidence for the benefits of the WIC program come from studies showing that both in the United States and in other countries, women receiving supplemental foods from other sources also experience a decline in the low birthweight rate (16).

Despite its ten year existence nationwide, this nutritional intervention program has not been as effective in West Virginia. Due in part to the unwieldiness of the program and the inability of the State to respond to early program initiatives, WIC did not become available statewide until October 1983. WIC presently serves only 28 to 30 percent of those West Virginians eligible under program criteria (17). Because of WIC budget constraints, the state program must rely on year-end unspent funds from other states to improve its distribution rate.

The concerted effort to improve low birthweight rates, state and nationwide, has resulted in much of the WIC food being furnished going to

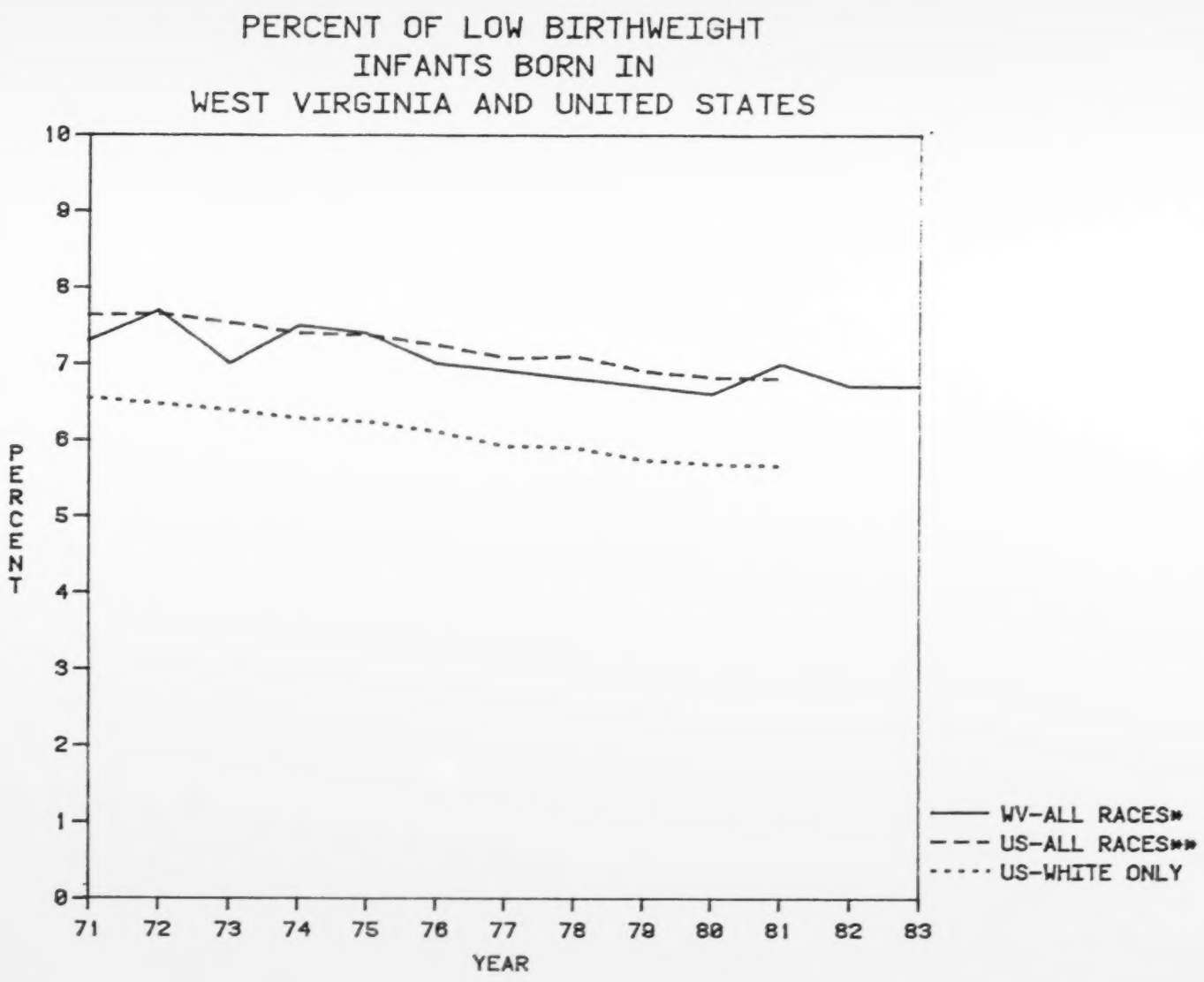
pregnant women rather than to infants and young children. The lack of resources for supplementing the diets of infants and children is particularly acute in West Virginia where the WIC program falls so far short of need. Further, given the effect of improved nutrition during pregnancy a WIC program serving only a small percentage of the eligible population can not be expected to have a substantial effect on the low birthweight.

4. Low Birthweight: The nutritional status of the mother prior to conception coupled with adequate nutrition and weight gain during pregnancy are among the most important factors in determining the birthweight of the infant (16). Both nationally and in West Virginia the improvement in the low birthweight rate over the past decade has been barely perceptable: from 7.6% in 1971 to 6.8% in 1981 for the United States and from 7.3% in 1971 to 6.7% in 1983 for West Virginia (Figure 1). Low birthweight and short gestation continue to be the fourth leading cause of death during the first year of life with most of these deaths occurring within 72 hours of birth.

As a result of the increased capability of saving the low birthweight infant through the provision of intensive care at birth, the neonatal death rate in West Virginia has fallen dramatically (from 17.0 in 1972 to 7.2 in 1982).

Saving the low birthweight infant is a costly enterprise. Basic hospitalization of an infant in intensive care costs $380 a day at one West Virginia medical center. Special services and physicians fees are additional. (Table 1) Recently, in West Virginia, $291,174 was spent on a single low birthweight infant (18).

FIGURE 1



*85.6% WHITE

**75% WHITE

TABLE 1

NEONATAL INTENSIVE CARE UNIT INFANTS
July 1983 - December 31, 1984

	#	Total Hospital Cost	Average Per Infant
~1000 Gms.	34	$1,424,130	$41,890
1000-1499 Gms.	64	1,699,320+	26,550
1500-1999 Gms.	75	1,139,890	15,200
2000-2499 Gms.	66	873,650	13,240

Pearson, 1985 (18)

5. Infant Mortality Rates: The customary way of judging a community's ability to provide for the wellbeing of its members is to examine the infant morality rates. Although these rates serve less well as they drop from hundreds of deaths per thousand to ten or below, they do reflect the general health of the most vulnerable segments of the population and thus serve as an indicator of the health of the larger group.

The overall infant death rate for the United States is relatively high; seventeenth among the industrialized nations. Nonwhite infants die at twice the rate of white infants. Comparisons between the United States and two countries having low infant death rates, (Norway and Sweden) indicate that the low birthweight rates account for the differences in infant mortality in the two countries. When only whites are considered, the United States infants are still at higher risk.

In 1982, the last year for which final figures are available from both

West Virginia and United States, West Virginia's overall infant mortality rate appears to compare favorably with the rest of the country; 11.5 to 11.4 per thousand infants born, respectively (19).

However, it should be noted that nonwhite births in the United States population comprise 25 percent of the total, and nonwhites have almost twice the infant mortality rate of the white group. In West Virgnia, only 4.4 percent of the births are to nonwhite mothers. This means that comparisons between United States and West Virginia rates can be misleading unless rates are compared separately for the white and nonwhite populations. Because of the low percentages of nonwhites, the numbers tend to be small, with the nonwhite rate fluctuating drastically from year to year. To increase the reliability of the data, average rates for the last three years for which there are final figures need to be used. In West Virginia this would be 1981, 82 and 83. During these three years, 77,948 white and 3,557 nonwhite were born. There were 895 infant deaths among whites, for a three year average mortality rate of 11.6 per thousand live births and 60 infant deaths among nonwhites for a three year rate of 16.9 (20, 21, 22). The United States rate for 1982, the last year a final report is available, was 10.1 for white infants and 17.3 for all nonwhites, (see Table 2) and 19.6 for blacks considered alone.

Table 2

INFANT, NEONATAL, AND POSTNEONATAL MORTALITY RATES

FOR WEST VIRGINIA AND UNITED STATES

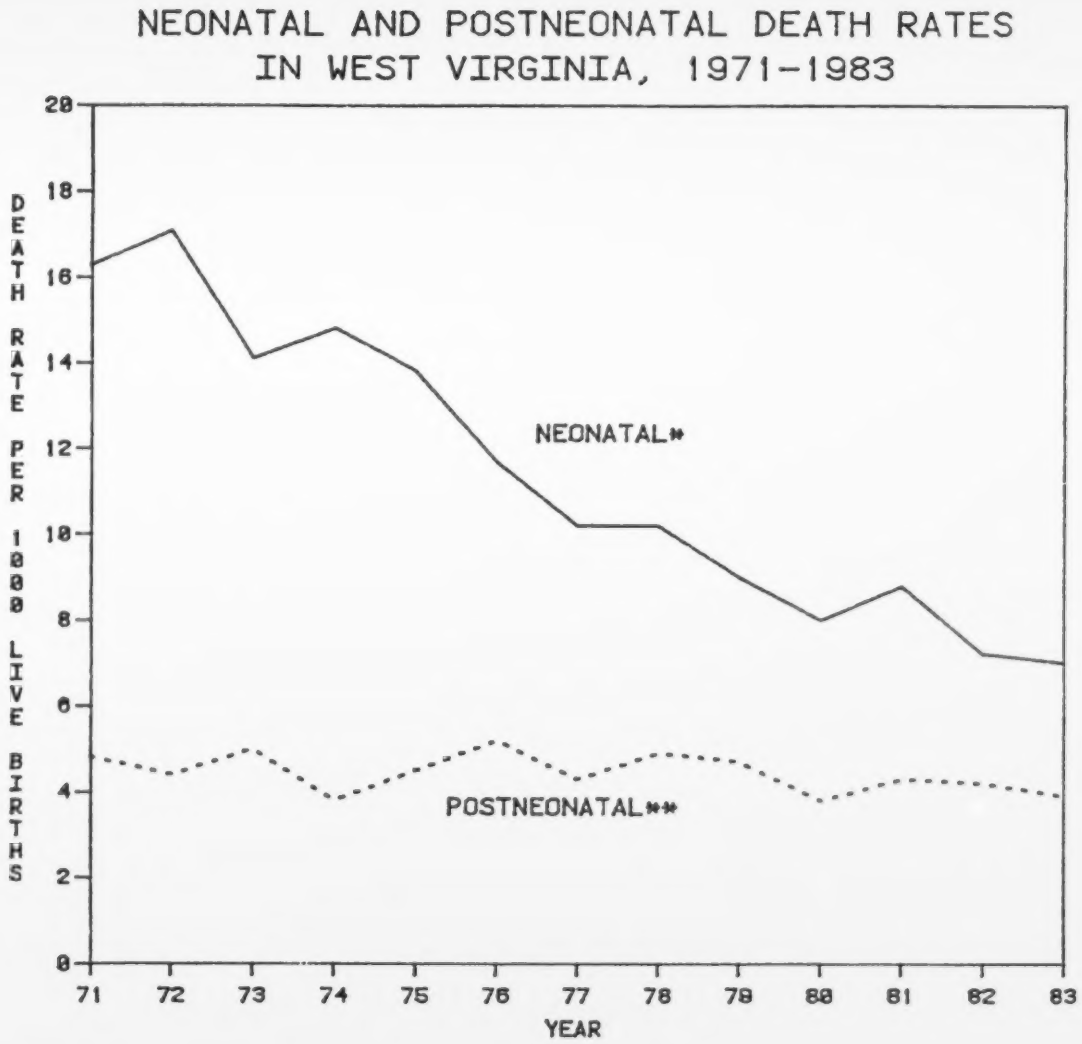
	Infant Mortality (under 1 yr)	Neonatal (~28 days)	Postneonatal (28 days-1 yr)
West Virginia, 1981-1983 Average			
White	11.6	7.5	4.0
Nonwhite	16.9	11.5	5.3
U.S. 1982			
White	10.1	6.8	3.3
Nonwhite	17.3	11.3	6.0

NCHS Monthly Vital Statistics Report (23,24)

West Virginia has one of the highest white infant mortality rates in the country. Three out of every 2,000 white West Virginia deaths during the first year of life can be attributed to simply having been born to residents of West Virginia. Nonwhite infants, on the other hand, had a slightly better chance of survival for having been born in West Virginia as compared to the United States overall.

To clarify the situation further, the infant morality rate is separated into the neonatal mortality rate (from birth through twenty-eight days) and the postneonatal rate (from twenty-eight days to one year). The average 1981-83 neonatal mortality rate in West Virginia for whites was 7.5 per thousand live births and 11.5 for nonwhites. The larger discrepancy between the two neonatal rates is generally attributed to the tendency for black women to have lower birthweight infants. Whether this tendency is due to inherent racial factors or to the decreased level of prenatal care, (including less nutritional support) has not been conclusively shown.

FIGURE 2



*UNDER 28 DAYS

**28 DAYS TO 1 YEAR

The postneonatal mortality rate tends to reflect socioeconomic factors including the nutrition of the infant. Currently West Virginia's postneonatal mortality rate is among the highest in the country at 4.0 for whites and 5.3 for nonwhites (23, 24). This rate has also shown little sign of decreasing over the last decade (Figure 2).

6. Heights of Children at School Entry: The most often used and most widely accepted measures of growth are height, weight, or height/weight indexes. Of these, height is considered the most sensitive and most reliable indicator of the long term effects of environment on growth of young children (25). Height provides an easily measured index of skeletal growth and maturation. Data are currently available from a study of the heights and weights of Monongalia children at school entry in 1983. This group of children failed to reach mean heights on either the Harvard Growth Standards (26) or the National Academy of Science Recommended Standards (NCHS)* (27). (Figures 3 and 4) Monongalia ranks among the top eight West Virginia counties in per capita income and yet children at school entry still fall (28) below national standards in height.

The Harvard standards are based on a long term study of several hundred children in Boston during the late 1930s and the 1940s. They are most often used to denote the more optimal size-for-age. The NCHS standards are based on more recent national cross-sectional studies and give an estimate of size-for-age of a more mixed population. Both of these measures are used to determine the extent to which children are meeting expected size-for-age. In any discussion of heights or weights of children it should be noted that within any population group there is considerable variation in size-for-age among individual children. These differences are to be expected in

FIGURE 3

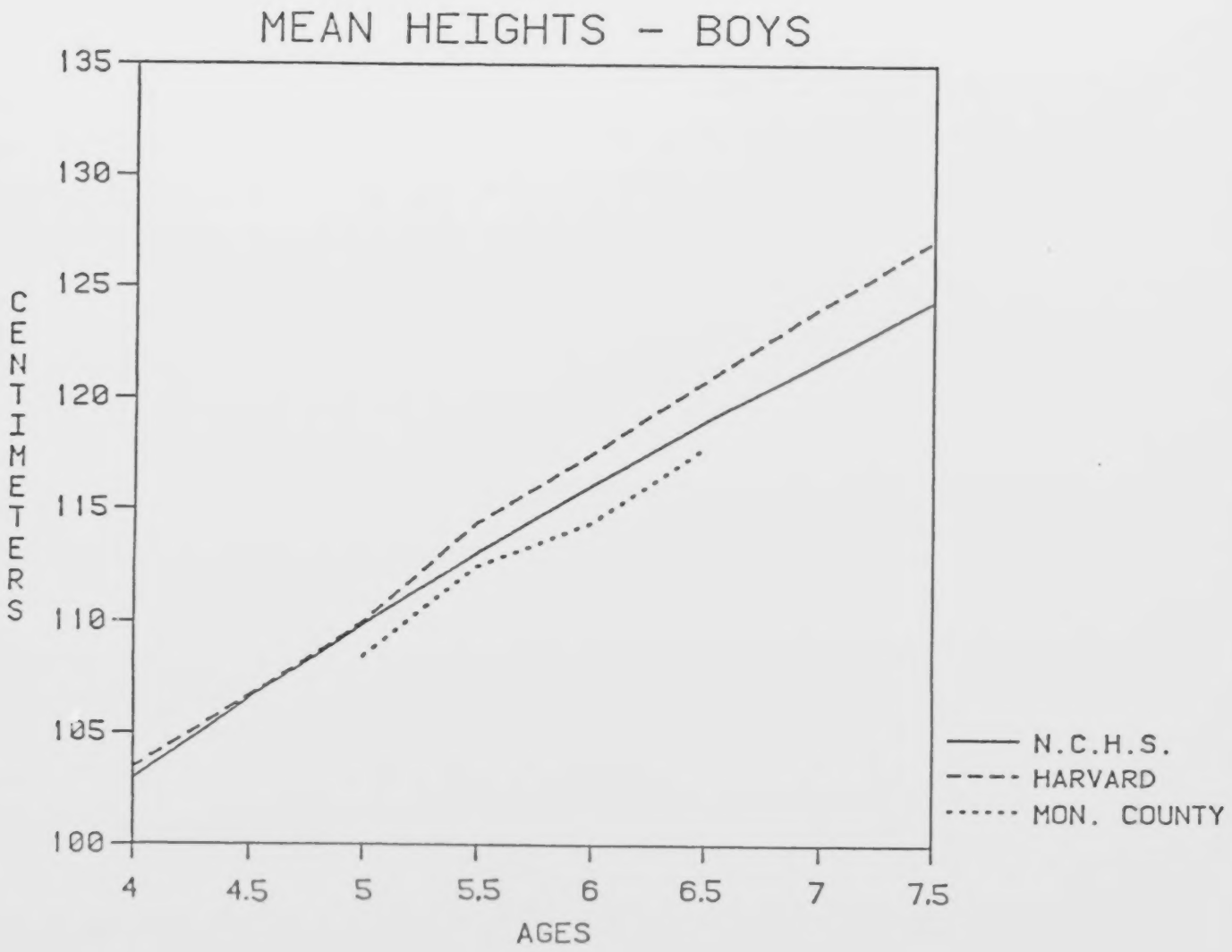
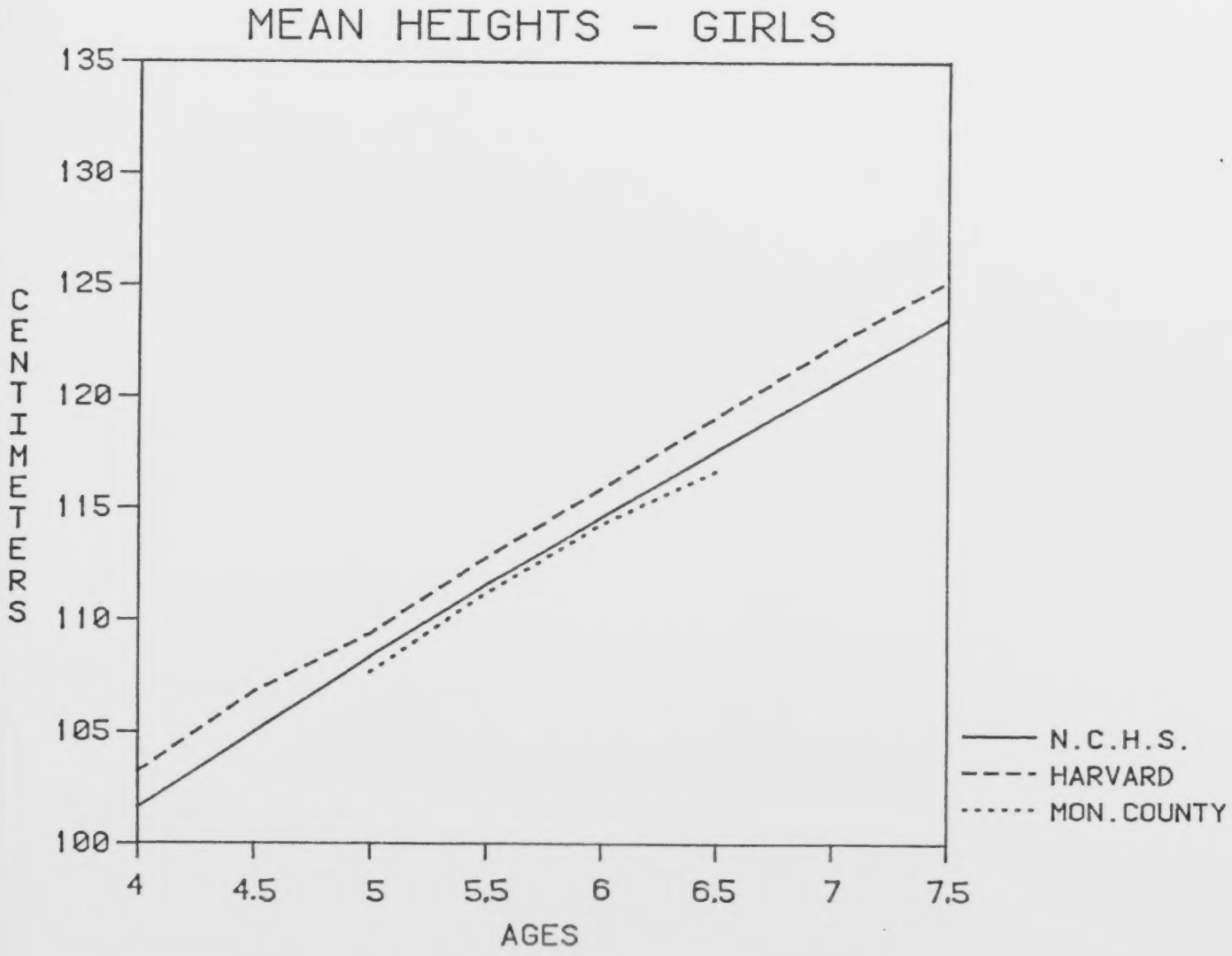

MEAN HEIGHTS - BOYS
135
130
125
120
115
110
105
100
CENTIMETERS
4
4.5
5
5.5
6
6.5
7
7.5
AGES
N.C.H.S.
HARVARD
MON. COUNTY

FIGURE 4


MEAN HEIGHTS - GIRLS
135
130
125
120
115
110
105
100
CENTIMETERS
4
4.5
5
5.5
6
6.5
7
7.5
AGES
N.C.H.S.
HARVARD
MON.COUNTY

the height-for-age within any group of preschool children. Although genetic factors influence adult height they are not expressed until puberty. The criteria for judging an individual child's growth status involve serial measurements to determine velocity and change over time.

If, however, the average height for an entire population is depressed, it means that there are more than the expected number of short-for-age children in the group. This is true of the NCHS children as compared to the Harvard children and it is also true of the Monongalia County Children as compared to the NCHS and the Harvard children. That the parents of the shorter children are also short is most likely to be a reflection of the parents early environment rather than genetics, and is believed due to their nutrition (as shown in postwar Japan and almost every other society studied).

7. Unemployment Rates: West Virginia has had and continues to have the highest unemployment rate in the United States; currently greater than 11 percent. Financial difficulties are not the only consequence of unemployment for families. Brenner's (29) work showed that as unemployment rose not only did mortality among the unemployed themselves rise within two years of the job loss, but wives and children, including infants, also died at increased rates.

It should be noted that Brenner's studies are based on ecologic data on employment and mortality for entire populations. Studies which examine relationships between variables directly effecting individuals and their

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*National Center for Health Statistics, Pre-school Nutrition Survey and Fels Institute Data.

risk of early death indicate (30) that it is not the unemployment itself but rather the myriad of unfavorable consequences of being out of work that account for the increased mortality rates. The unemployed and their families are more likely to be less well sheltered, fed or provided with the amenities which serve to insure good physical or psychological health.

III EFFECTS OF MALNUTRITION ON THE HEALTH OF CHILDREN.

Many of the effects of undernutrition on the growth and development of children have been well established. The questions remaining pertain to the extent of the damage and the degree to which it is reversible or affected by other environmental factors.

The most obvious effect of undernutrition or of malnutrition is the delay or stoppage of physical growth. But it may also jeopardize intellectual and emotional development (31,32).

Two distinct effects of prenatal undernutrition have been noted. The fetus deprived of adequate nutrients early on or consistently throughout pregnancy will be proportionately smaller, with the brain deprived to the same extent as other organs. Secondly, if deprivation occurs late in pregnancy when brain cell division is at its peak, growth failure will be disproportional. As the system tries to protect the developing brain, the head will grow out of proportion to the body, producing an infant with a notably large head and small torso. Both groups of infants are of lower than usual birthweight and are apt to exhibit other signs of distress. These children can be identified with relative ease and measures can be taken to prevent further deprivation and foster wellbeing. Significantly, in West Virginia there is no systematic follow-up of the approximately 1,700 low birthweight infants (over six percent of the total) born each year (33).

The certifiably low birthweight infants, however, may represent only the most obviously impaired. Some of those having birthweights over 2,500 grams (five and one-half pounds) also may have failed to reach full potential in terms of birthweight. If they had had an optimum prenatal environment they may have developed even more fully.

In addition to those endangered before birth, there are those children who are of adequate size at birth but who, as a result of inadequate nourishment and other environmental stresses such as recurrent infections, fail to maintain growth either in terms of absolute size-for-age or in velocity. While the chief nutritional factors involved are high quality proteins, calcium, iron and vitamin A, all of the essential nutrients play a role, as does total calories. As a general rule, the higher the caloric intake, the better the chances are that the diet will contain adequate nutrients. In the presence of inadequate calories, the protein intended to support growth will be converted to glucose to be used for energy. Surveys have shown that in most of the United States, even among low income families, the protein intake of the children tends to be relatively high but this is not the case for other nutrients needed for growth, particularly iron, calcium, vitamin A, and total calories (3, 4, 34).

As caloric intake ceases to meet physiologic need, bone growth is slowed, and bone tissue becomes less dense and develops fissures. As available protein decreases, bone growth stops, bone thinning continues, and the reduced height of the child becomes pronounced. Wasting of muscle and other soft tissues accompanies this process, but below average weight may also reflect an acute illness episode or more recent dietary history (35, 36). For this reason weight alone is not a satisfactory guage of long term nutritional state.

Shortened stature and lighter weight are the most easily discerned consequences of an inadequate food intake. If they were the only effects, they might not be of particular concern; small size in itself may not be a disadvantage. Short stature reflecting a weakened skeletal structure, however, is another matter. Further, malnutrition of the infant and young child has been associated with increased susceptibility to infectious diseases as well as decreased mental capacity and exaggerated response to stress (37-51). The interaction between infection and malnutrition has been long suspected, but only in the last twenty years past has it been clearly documented (37, 38). As nutritional status is impaired, particularly in respect to Vitamins A and C and to protein, the immune system becomes compromised and resistance to infection decreases. Further limitation of food intake during illness results in increased susceptibility, and a downward spiral is put in motion which contributes not only to growth retardation but can also result in death, especially among infants and young children. An excess of deaths from infectious disease among this group may be taken as an indication of poor nutritional status, even though poor nutritional status is not listed as a cause of death.

The deleterious mental and emotional effects of inadequate nutrition in young children have been delineated over the last fifteen years. Winick demonstrated through autopsy studies that compared with well fed children, children malnourished before the age of eight months develop fewer brain cells and children malnourished after the age of eight months have smaller brain cells (39). This is significant because brain cells (as other cells) are developing at their greatest rate just before and for the first few months after birth. Eighty percent of brain cell growth is achieved by the

age of three, ninety percent by the age of four. Decreased brain cell number and size are also correlated with decreased head circumferences in children under three, providing another measure of the effects of nutritional deprivation (40).

Animal studies indicate that severe early malnutrition is also associated with altered brain wave patterns and a delay in maturation in electrical activity (41-43). This has been seen in children convalescing from protein-calorie malnutrition who display abnormal gait and tremors (44). A study of army recruits in Holland points out that damage to the central nervous system was the most pronounced lasting effect of undernutrition prior to birth (45).

Neurological aberrations may not be the only behavioral consequences of malnutrition in the young. Animal studies have shown that among those poorly nourished during early life there is a tendency toward exaggerated emotional responses that persist into adulthood as a result of permanent damage to the adrenal glands (46-50). A recent study indicates that this is also true for children (51).

Numerous studies have shown that malnourished children have lower scores on standardized psychological tests and poorer school performance (52-58). This association can be demonstrated even after accounting for the effects of other socioeconomic factors. Those children malnourished prior to the cessation of brain cell division appear to be permanently affected, while those experiencing malnutrition after that time improve in test performance and learning ability as their condition improves.

There is an aspect of these effects which is both hopeful and discouraging. If young children experiencing malnutrition are placed in

stimulating environments, fed well, and protected from further stress, they tend, after some years, to perform at normal or near normal levels on standard IQ tests. If these children are left in non-stimulating environments, no improvement is shown (59, 60). The extent to which deficits in intellectual ability may be overcome through later environmental changes is not clear. Could these same children have exceeded the norms under more favorable circumstances? It is known that, despite accelerated catch-up growth in height and weight, full physical growth potential is not attained (31, 61).

Nutritional deprivation manifests itself throughout a lifetime. An example of the continuing effect may be seen in skeletal abnormalities in adulthood. Women who have not developed a pelvic structure sufficiently large to allow the fetus to attain full potential size, further contribute to the low birthweight problem by constraining the growth of the fetus. Additional effects on the skeleton may be displayed in the form of increased fragility. One problem more often experienced by women than men is the development of osteoporosis in later life. This disease is not only disabling but accounts for a substantial number of deaths each year in the United States as a result of complications from falls and fractures.

Other skeletal disorders which may be associated with underlying skeletal fragility, low back injury for instance, account for numerous visits to physicians and great cost in medical care and work time lost each year in the United States. According to the National Foundation for Workers Compensation, West Virginia ranked highest in worker's compensation with a cost of $399 per employee in 1982. The United States average was $180 (62). This ranking is corroborated by data from the Social Security

Administration (63) which cites West Virginia as having the highest prevalence rate for work related disability in the country. In this study, the southern states including Arkansas, Georgia, Mississippi and Kentucky as well as West Virginia had the highest disability rates. This is also the area of the country that is shown in health and nutrition surveys to have the poorest dietary intakes and most nutrition related health problems (3, 4, 64).

A recent editorial in the West Virginia Medical Journal (65) on workers' compensation costs calls for medicine, labor and business to come together and work toward "legitimate solutions and appropriate legislation which could alleviate this intolerable situation." What should the nature of this legislation be? Is the answer primarily in correcting purported abuses in the system or is it in improving the health of the worker and thus preventing the injuries? How many of the present injuries are fully attributable to the nature of the work engaged in? How many, at least in part, reflect the longterm effects of an inadequate skeletal structure?

The answers to these questions can, at this stage of scientific knowledge, only be guessed at. What is clear, however, is that nutritional wellbeing in terms of both quantity and quality of foods consumed is directly related to the health of individuals and thus to that of the total population.

IV. POSSIBLE EFFECTS ON ECONOMIC POTENTIAL.

As resources dwindle distribution of food within not only the community, but also within the household becomes difficult. Those individuals upon whom the survival of the family depends, or in whom the hopes of the family

for the future have been placed would seem to be the beneficiaries. Who the preferred individual is, may differ among cultures and subcultures. Studies (64-66) have shown that while many children of both genders fail to reach expected height and weight, growth failure tends to occur at a higher rate among preschool girls than among boys. Hepner, a pediatrician at the University of Maryland in Baltimore claimed that among the urban black population of Baltimore the most likely candidate for failure to thrive or growth failure would be the male infant or young boy (67). In white populations, including Appalachia, it appears that the female child is in greatest need of protection from nutritional deprivation.

White women along the Appalachian chain (between northeastern Pennsylvaina and southern West Virginia) have the highest mortality rates for white females in the United States (68). How much the apparent early deprivation of female children effects subsequent development, and may account for increased untoward outcomes of pregnancy or contribute to the early mortality among Appalachian women is not fully known. But early deprivation may be expected to create a spiral effect operating through the generations. It is believed by some (69, 70) that British working class women are still paying the price of Britain's rapid industrial development and that present excessive mortality among them will not be alleviated until at least one generation is reared in an environment which allows the complete expression of genetic potential. The lowering of infant mortality rates and disappearance of class and regional differences in heights among Swedish school children substantiates this belief (71).

The provision of food to families and individuals in need, amounts to increasing the income of those persons. A more direct method is to provide

cash for basic survival needs. In many states and countries such support has been meager while in others, because of differing economic bases or social philosophies, aid has approximated the median income level of the group. Could these differences have changed the destinies of the societies involved? Some nations and states seem already to have reaped the benefits of this long term strategy.

For the last several generations the Scandanavian countries have been able and willing to distribute resources to ensure a living standard for all substantially above mere survival. At the present, Sweden is the only nation in which the population seems to have reached its potential in height. This has only been documented for a few advantaged subgroups, one being Harvard graduates whose fathers, grandfathers, and great grandfathers also graduated from Harvard (2).

In the United States, payments to families with dependent children have varied greatly among the states, with the more populated and more industrialized states generally able to meet a higher percentage of survival needs (as objectively determined by economists) than others. Some states not fitting these categories, however, have also been able to provide for families at a higher level. For example, Vermont and Maine provide aid to families with dependent children up to twice that in states with similar populations (i.e., rural, white, low income). Although child growth data is not available for these states, infant mortality rates are. Three year average infant mortality rates (1980-1982), were 9.2 per 1,000 live births for Vermont and 9.7 for Maine (19, 24, 25). During the same time period infant mortality was 12.0 per 1,000 for West Virginia.

Some underdeveloped countries have taken note of relationship between food distribution and economic goals. A national nutrition policy was developed for Columbia when the South American nation discovered that a large percentage of its school children were incapable of learning beyond the early grades. Doing so represented a longterm view recognizing that only as the skill levels of individuals increased could the nation achieve much needed economic development.

Closer to home is the example of Massachusetts. During the late forties and early fifties, Massachusetts suffered severe economic depression when the shoe and textile industries moved south and again in the early seventies when the aerospace industry collapsed. In 1978 the unemployment rate in Massachusetts was 11.2 while the United States rate was 8.5 (72). Despite having all five counties (containing 5.9 million people) declared economic disaster areas over this thirty year period, levels of aid to families with dependent children remained relatively high and Massachusetts consistently experienced infant mortality rates below the national average.

By 1984 Massachusetts had an unemployment rate of 4.8 percent as compared to the national rate of 7.5 percent and the state had the fourth highest per capita income in the country. Currently (1985) Massachusetts has the lowest unemployment rate in the nation, 3.9 percent, while the rate for the United States remaining over 7 percent. Many of the sons and daughters of the mill and factory workers are now employed either in computer-age industries or in providing the services to support these industries.

While it is recognized that Massachusetts has a long heritage of industry and capital wealth, the state had become a leading example of the decaying industrial northeast with its severely eroded economic base.

Should its recovery be attributed to some magic or perhaps to the state's long commitment to maintaining the health and fostering the education of its citizens? Or looking further back could it be that the people of Massachusetts, like the northwest indians, were blessed with abundent protein from the sea?

V CONCLUSION AND RECOMMENDATIONS.

There is no adequate justification for anyone especially children in the United States to be at nutritional or other risk even in those states plagued by economic problems including high unemployment. Resources exist on both the state and national level to alleviate the situation; they need only be judiciously applied.

Ill-fed children do not fully develop physically, mentally or emotionally, and these effects are independent of other environmental factors such as poor sanitation, lack of early stimulation, or faulty parent-child relationships. These other factors serve primarily to make the situation considerably worse by interacting with the nutritional problems in a way that is multiplicative rather than additive. The end result is children who are uneducable at the level demanded by today's highly technological society and thus as adult employable only at the lowest skill levels.

Although the issues have differed, several states in the past year have led the way in taking steps to protect their children (73). Massachusetts, Indiana, New York and Ohio through the establishment of governors' taskforces, the determination of individual legislators, and the work of child advocates from every level of the community have succeeded in passing

legislation aimed at further enhancing and protecting their children.

It is recommended that:

A. There be a panel of West Virginia's leaders in government, education, business and labor convened to further explore this issue and make recommendations as to how these groups might best combine forces to ensure a well fed, and thus productive and viable population in West Virginia.

B. A statewide nutrition and health survey be conducted to assess the present nutritional status of West Virginia's population.

C. A monitoring and surveillance system be put in place to ascertain the nutritional wellbeing and growth status of West Virginia's children on a continuing basis. Mandated statewide nutritional screening of children at school entry would be a beginning, although it will be already too late at the point to fully restore those found to have been deprived during the preschool years.

D. A single well placed individual within state government whose business it is to oversee the nutritional wellbeing of West Virginia's children.

It is expected that any true solution of present deficits will involve additional efforts on the part of each of the forces serving on such a panel. Both the direct and indirect costs of not taking such action are clearly unacceptable. Dollar costs include not only the initial costs of neonatal intensive care for low birthweight newborns but the lifelong care of many of these same individuals. The United States Office of Technology Assessment estimates that lifetime custodial care is presently averaging $350,000 per individual and cost for special education and health care is

about $123,00 for each child needing these services. Additional costs include $3,000 for every child who repeats a grade in school (73) and the difference in lifetime earnings of those whose educational potential has been jeopardized by poor nutrition or related poor health. The human costs of inaction are at least as great.

The enormity of the problem calls for long term committment and effort on the part of all of those concerned about West Virginia's future. No one time, short term solution will suffice. Long term planning and investment is essential if West Virginia is going to have a viable economic future. "Where there is no vision the people perish" (Proverbs 29:18).

REFERENCES

1. Honigmann, J.J., Understanding Culture, New York: Harper & Row, 1963.

2. Tanner, J.M., Growth as a monitor of nutritional status, Proc. Nutr. Soc., 35:315-22, 1976.

3. U.S. Department of Health, Education, and Welfare, Ten-State Nutrition Survey 1968-1970, DHEW Publ. NO (HSM) 72-8133.

4. Data from the National Health Survey, Vital and Health Statistics Series 11 #226-232, DHHS Publ No. (PHS) 83-1676-1682, 1983.

5. Hunger in America: The Growing Epidemic, Physician Task Force on Hunger in America, Harvard University School of Public Health, 1985.

6. Hunger in West Virginia, West Virginia Food-Law Project, Gassaway, West Virginia, 1983.

7. Food Marketing Institute Survey of 1,500 Adults, Published in USA Today, June, 1985.

8. Personal communication, Donald Roberts, Food Stamp Program, West Virginia Department of Human Services, June, 1985.

9. Garland, B.K., Survey of Maternity and Infant Care Project Families, Frankfurt, KY, Kentucky State Dept. of Health, 1968.

10. Personal communication, Nelson Ellifritz, Gassaway Food Bank, June, 1985.

11. Surplus Food Program Document, Department of Human Services, June, 1985.

12. Personal communication, Naomi Bowlby, Food Bank, Scots Run Settlement House, Osage, West Virginia, June, 1985.

13. U.S. Bureau of the Census, Statistics Abstract of the United States: 1985, (105th Edition) Washington, D.C., 1984.

14. Filer JR, L.J. Chairman, Committee on Nutrition, American Academy of Pediatrics. Childhood Diet and Coronary Heart Disease, Pediatrics, 49(2):305-7, 1972.

15. Laird, W.P., Childhood and diet as related to atherosclerosis, Clinical Pediatrics, 14(5):485-6, 491-4, 1975.

16. Committee to study the prevention of low birthweight, Behrman, R.E., Chairman, Preventing Low Birthweight, Washington, D.C.: National Academy Press, 1985.

17. Personal communication, Allen Rhodes, WIC Program, West Virginia Department of Health, June, 1985.

18. Pearson, R.J.C. and Dacey, A. Department of Community Medicine, West Virginia University, unpublished data on low birthweight costs, 1985.

19. Advance Report of Final Mortality Statistics, 1982, NCHS Monthly Vital Statistics Report, 33(9) Supp.:39, 1984.

20. West Virginia Department of Health, Vital Health Statistics of WV 1981, Charleston, WV, State of West Virginia Department of Health, 1983.

21. West Virginia Department of Health, Vital Health Statistics of WV 1982, Charleston, WV, State of West Virginia Department of Health, 1984.

22. West Virginia Department of Health, Vital Health Statistics of WV 1983, Charleston, WV, State of West Virginia Department of Health, 1985.

23. Advance Report of Final Mortality Statistics, 1980, NCHS Monthly Vital Statistics Report, 32(4) Suppl., 1983.

24. Advance Report of Final Mortality Statistics 1981, NCHS Monthly Vital Statistics Report, 33(3) Suppl., 1984.

25. Watson, E.H. and Lowery, G.H., Growth and Development of Children, Chicago: Yearbook Medical Publishers, 1962.

26. Stuart, H.C. and Stevenson, S.S., Physical growth and development. In: Nelson, W.E. (ed) Textbook of Pediatrics, 5th ed., Philadelphia: W.B. Sounders, 14-73, 1950.

27. NCHS Growth Curves for Children: Birth - 18 Years, Vital and Health Statistics, Series 11, #165, DHEW Publ. No (PHS) 78-1650, 1977.

28. Garland, B.K., Unpublished data on growth and development of Monongalia County children upon school entry.

29. Brenner, M.H., Mortality and the National Economy: A Review, and the Experience of England and Wales 1936-1976. Lancet, ii 568-73, 1979.

30. Grovelle, H.S.E., Hutchinson,G., and Stern, J., Mortality and Unemployment: A critique of Brenner's time-series analysis, Lancet, 675-9, Sept. 26, 1981.

31. Schulman, I., Iron Requirement in Infancy, J. of the Amer. Med. Assn., 175:118-23, 1961.

32. Ashworth, A. and Waterlow, J.C., Calorie and Protein Intake and Growth, Lancet, 1:776-7, 1969.

33. Brown, P., Pearson, R.J.C., Wolf, H., Unpublished data on tracking infants "at risk."

34. Edozien, J.C., et al. Medical Evaluation of the Special Supplemental Food Program for Women, Infants and Children, Chapel Hill, N.C.: Department of Nutrition, School of Public Health, University of NC, 1976.

35. Garn, S.M., Bone Ossification and Skeletal Development, In: Pre-School Child Malnutrition: Primary Deterrent to Human Progress, Washington, D.C.: National Academy of Science, 1966.

36. Dickerson, J.W.T. and John, P.M.V., The Effect of Portein-Calorie Malnutrition on the Composition of the Human Femur, British J. Nutr., 23:917-24, 1969.

37. Scrimshaw, N.S., Taylor, C.E. and Gordon, J.E. Interactions of Nutrition and Infection, WHO MOnograph, Series No. 57, 1968.

38. Powanda, M.C. Changes in Body Balances of Nitrogen and Other Key Nutrients: Description and Underlying Mechanisms, American Journal of Clinical Nutrition, 30:1254-1268, 1977.

39. Winick, M. Malnutrition and Brain Development, Journal of Pediatrics, 74:667-679, 1969.

40. Dobbing, J. Vulnerable Periods of Brain Development, In: Lipids, Malnutrition and the Developing Brain, Amsterdam: Association Scientific Publication, 9-20, 1972.

41. Fish, I and Winick, M. Cellular Growth in Various Regions of the Developing Rat Brain, Pediatric Research, 3:407-412, 1969.

42. Platt, B.S. and Stewart, R.J.C., Effects of Protein-Calorie Deficiency in Dogs, Developmental Medicine and Child Neurology, 11:174-92, 1969.

43. Stewart, R.J.C., The Influence of Protein-Calorie Deficiency on the Central Nervous System, Proceedings Nutrition Soc., 27:95-101, 1968.

44. Baraister, M. and Evens, D.E., The Effect of Undernutrition on Brain Rhythm Development, South African Med. J., 43:56-8, 1969.

45. Stein, Z. and Susser, M., The Dutch Famine 1944-45, Pediatric Res., 9(2):76-83, 1975.

46. Barnes, R.H., Moore, A.U. and Pond, W.F., Behavioral Abnormalities in Young Adult Pigs Caused by Malnutrition in Early Life, J. of Nutr., 100:149-55, 1970.

47. Smart, J.L. and Dobbing, J., Vulnerability of Developing Brain, Developmental Psychobiology, 5:129-35, 1972.

48. Cowley, J.J. and Friesel, R.D., The Development of Second Generation Low Protein Rats, Journal of Psychology, 103:233-42, 1963.

49. Frankova, S. and Barnes, R.H., Effect of Malnutrition in Early Life on Avoidance Conditioning and Behavior of Adult Rats, J. of Nutr. 96:485-93, 1968.

50. Levitsky, D.A. and Barnes, R.H., Nutritional and Environmental Interactions in the Behavioral Development of the Rat, Science, 176:68-71, 1972.

51. Barrett, D.E. and Radke-Yarrow, M., Effects of Nutritional Supplementation on Children's Responses to Novel, Frustrating, and Competition Situations, Amer. J. of Clinical Nutr. 42:102-20, July, 1985.

52. Stoch, M.B. and Smythe, P.M., The Effect of Undernutrition During Infancy on Subsequent Brain Growth and Intellectual Development, South African Med, J., 41:1027-30, 1967.

53. Cravioto, J. and Robles, B., Evolution of Adaptive and Motor Behavior During Rehabilitation from Kwashiorkor, Amer. J. of Orthopsychiatry, 35:449-64, 1965.

54. Chase, H.P. and Martin, H.P., Undernutrition and Child Development, New England J. of Med., 282:933-9, 1970.

55. Yatkin, U.S. and McLaren, D.S., The Behavioral Development of Infants Recovering from Severe Malnutrition, J. of Mental Deficiency Res., 14:25-32, 1970.

56. McLaren, D.S., Yaktin, U.S., Kanawati, A.A., Sabbagh, S. and Kadi, Z., The Subsequent Development of Rehabilitated Marasmic Infants, J. of Mental Deficiency Res., 17:273-81, 1973.

57. Richardson, S.A., Birch, H.G. and Hertzig, M.E., School Performance in Children Who Were Severly Malnourished in Infancy, Amer. J. of Mental Deficiency, 17:623-32, 1973.

58. Monckeberg, F., Tisler, S., Tore, S., Gattals, V. and Vega, L., Malnutrition and Mental Development, Amer. J. of Clinical Nutr., 25:766-72, 1972.

59. Winick, M., Meyer, K.K. and Harris, R.L., Malnutrition and Environmental Enrichment by Early Adoption, Science, 190:1173-5, 1975.

60. Nguyen, J.L., Meyer, K.K., and Winick, M.. Early Malnutrition and "Late" Adoption, Amer. J. of Clinical Nutr., 30(10):1734-9, 1977.

61. Thomson, A.M., The Evaluation of Human Growth Patterns, Amer. J. of Diseases of Childhood, 120:398-403, 1970.

62. Fiscal Data for State Workers' Compensation Systems 1982, 1981 and 1973. Bulletin #29 W.C. National Foundation for Unemployment Compensation and Workers' Compensation, March, 1985.

63. Sando, M.E., Prevalence of Work Disability by State, 1976, Social Security Bulletin, 42(5), 1979.

64. Report of the North Carolina Nutrition Survey: Part 1, Raliegh, N.C.: North Carolina State Board of Health, 1971.

65. Editorial, Further Ammunition, The WV Medical J., 81:127, June, 1985.

66. Garland, B.K., Dissertation Psychosocial Aspects of Growth Retardation, Chapel Hill, N.C.: Department of Epidemiology, University of North Carolina, 1978.

67. Hepner, R. and Maiden, N., Mothering and Malnutrition, Presented to American Public Health Association, 1972.

68. Sauer, H., Geographic Patterns in the Risk of Dying and Associated Factors: Ages 35-74 Years, Vital and Health Statistics Series 3, #18 DHHS Publ. No. (DHS) 80-1402, 1980.

69. Baird, D., Environment and Reproduction, Br. J. Obstet. Gynaecol., 87:1057-67, 1980.

70. Baird, D., Changing Problems and Priorities in Obstretrics, Br. J. Obstet. Gynaecol., 92:115-21, 1985.

71. Lindgren, G., Height, Weight and Menarche in Swedish Urban School Children in Relation to Economic and Regional Differences, Ann. Hum. Biol., 3:501-28, 1976.

72. Alm, R., How Massachusetts Rebuilt its Image, U.S. News and World Report, 73-4, Jan. 28, 1985.

73. State Child Care Stratagies Payoff, COF Reports 7:5 4-5, 1985.